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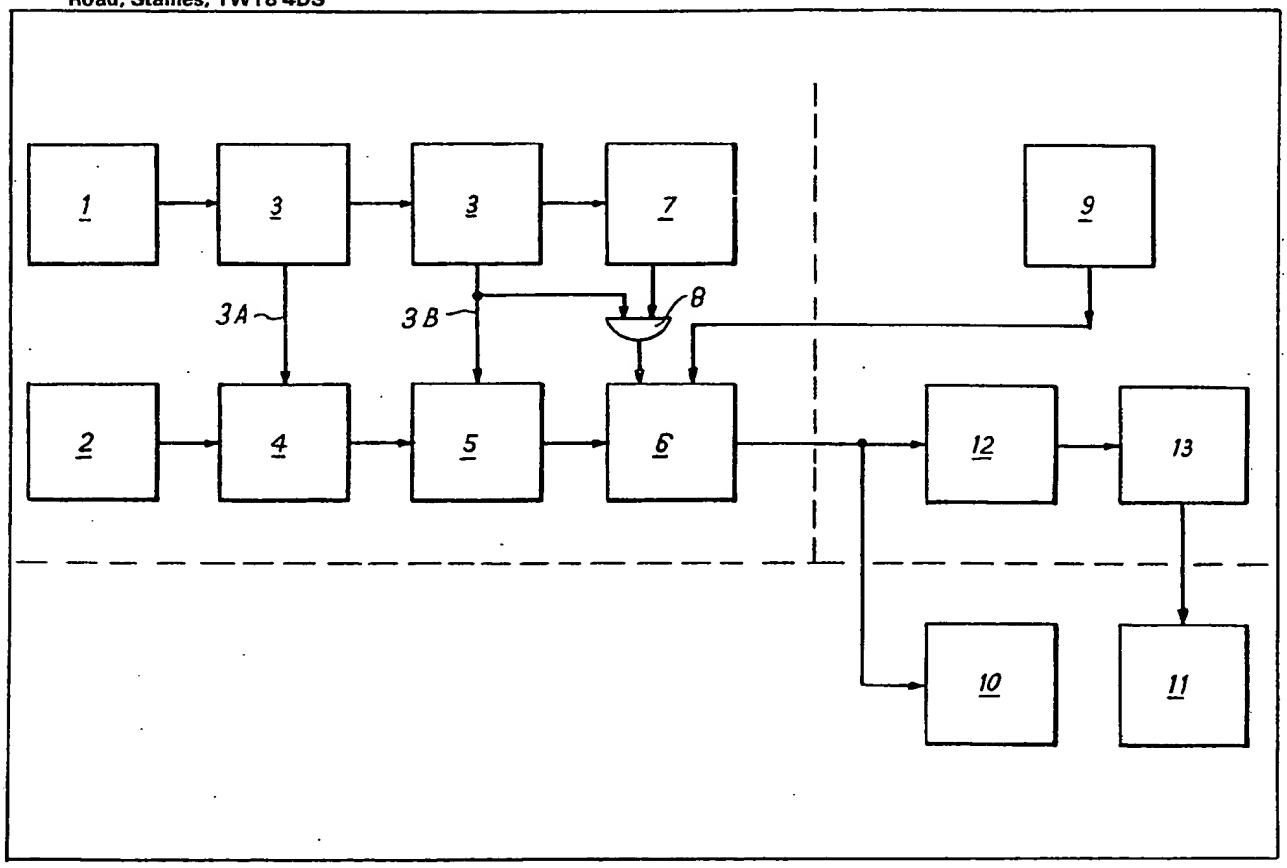
(54) **Data storage systems**

(57) A device for recording and storing information in respect of the variation of a predetermined parameter over a period of time comprises a first oscillator (1) arranged to oscillate at a frequency providing a reference standard, a second oscillator (2) of which the frequency of oscillation varies with the variation of said parameter, a counter (5) connected to the output of the second oscillator by way of a sampling gate (4), a memory (6) connected to the output of said counter, and a monostable (3) arranged to control operation of the sampling gate (4) and a means (7) for causing the output of the counter (5) to be read into addresses of the memory (6). The counter (5) receives a count from the oscillator (2) in accordance with the period of the monostable (3) and this count is read into selected addresses of the memory at intervals, to provide a record of the variation in frequency of the oscillator (2). The information stored in the memory can be recovered by a decoding unit.

The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.

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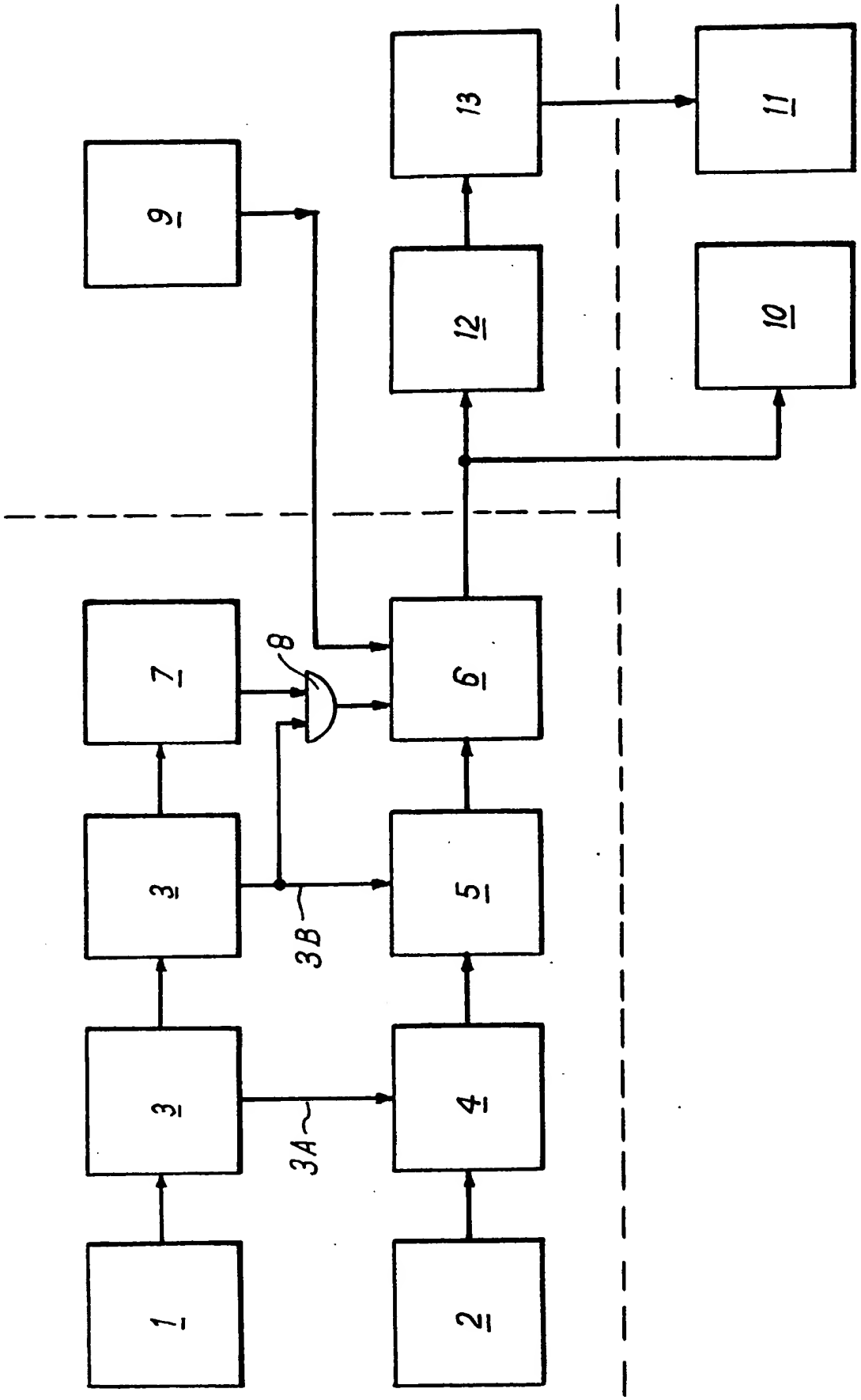

SPECIFICATION

**Impr vements in data storage systems**

This invention concerns improvements in and relating to data storage systems, and concerns more especially a system for recording and storing information in relation to the variation of a predetermined parameter over a period of time.

It is often required to obtain a record of the variation of a parameter over a period of time, and a variety of means, such as chart recorders, tape recorders, etc., are available for this purpose. In some cases, however, it is required that an information sensing and storage system should be constructed as a portable unit capable of being located in an environment from which information is to be derived, and to which convenient access is not possible at the time when recording of the information is to be effected. For example, in cases where a product is to travel through a continuous manufacturing or other process, and a record is required of a parameter or parameters to which the article is subjected during treatment, it is necessary to construct an information storage and recording device as a portable unit capable of travelling with the product and storing information on a parameter to which the product is subjected. In the case of a canning process, for example, such information may be obtained by means of a portable unit installed in a selected can arranged to travel on a production line together with a series of other cans to be treated.

In such circumstances, the recording and storage of information on the variable parameter has hitherto posed considerable difficulties owing to the limitations of the hitherto known data recording and storage system. For example, it has hitherto been proposed to obtain such information by radio telemetry from a portable sensor device. Although such a system is accurate and is the only system that can give information while it is happening, it is susceptible to noise and interference and requires an aerial installation within the plant which can be costly. Another hitherto proposed system involves the use of miniature tape recorders, or mechanical chart recorders, but such systems have the disadvantage that they are not sufficiently resistant to elevated temperatures, and require considerable insulation. Also, the systems are relatively bulky.

It is accordingly an object of the present invention to provide a device for recording and storing information which is capable of being constructed in an compact and readily portable form, which has no moving parts and which is not unduly susceptible to elevated temperatures or electrical noise or interference.

In accordance with the invention there is provided a device for recording and storing information in relation to the variation of a predetermined parameter over a period of time, comprising a first oscillator arranged to oscillate at a frequency providing a reference standard, a second oscillator of generally similar characteristics t the first but incorporating an element of which the characteristics vary with said predetermined parameter whereby the oscillator frequency correspondingly varies, a counter connected to the output of said second oscillator by way of a sampling gate, a memory connected to the output of said counter and providing a plurality of information storage locations or addresses, a monostable of which the period is controlled by said first oscillator, said monostable providing a first, set period during which the sampling gate is opened to permit actuation of the counter by the output of the second oscillator and a second, reset period during which the staticised output of the counter is made available to be read into the memory and then the counter is reset, and means, actuated either during each reset period of the monostable or during selected reset periods, for causing the output of the counter to be read into a corresponding location of the memory and for preparing a new location in the memory to receive the next count to be read therein.

A device in accordance with the invention has the advantage that it is capable of being constructed in relatively compact form as a self-contained, re-chargeable electronic unit, which is capable of recording and storing information without the requirement for moving parts, and which is readily interogatable for recovery of the information at the end of the period of time in recording has taken place.

In accordance with one embodiment of the invention, the parameter in respect of which information is to be stored is temperature, and the two oscillators are constructed of components which, with the exception of the specific temperature sensor element providing for variation of the frequency of the second oscillator, are closely matched to one another so that any variation of characteristics with temperature is the same for both oscillators. Thus the system is compensated against temperature variations, and can provided the degree of accuracy that is required.

One embodiment of the invention is illustrated by way of example in the accompanying diagrammatic drawing, the single figure of which is a block diagram of a device in accordance with the invention.

Referring to the drawing, the system comprises two oscillators 1 and 2, which are, for example, transistorised devices of which the respective components are carefully matched to one another as regards their temperature responsive characteristics, with the exception that the oscillator 2 incorporates a temperature responsive element, such as a thermistor, in the place of a corresponding fix d valu element of the scillator 1, so that the oscillator 1 provides a fixed reference frequency, whereas the oscillator 2 provides a frequency which is temperature dependent. The output of the oscillator 1 is fed to a monostable device 3, f which a first, set output 3A is applied to a sampling gate 4, and a second, reset output 38 is applied to a bindary counter 5.

The sampling gate 4 is arranged between the output of the oscillator 2 and the binary counter 5, and the output of the latter is applied to the input of a memory 6.

The monostable 3 is also arranged to control the period of a further timing element 7 such as a ripple counter, of which the output is connected to an AND gate 8 to which is also connected the output 3B from the monostable 3. The output from the AND gate 8 is connected to read input of the memory 6.

The device described above forms a self-contained data sensing and storage unit which operates as follows. The monostable 3 is controlled by the output of the oscillator 1 to provide set and reset periods of approximately one second each, so that for one second the sampling gat 4 is opened to enable the binary counter 5 to receive the output from the oscillator 2, and thus to count the pulses transmitted from the latter. During the following period of one second the reset output 3B of the monostable causes the count within the binary counter 5 to be stored and available to be read into the memory 6. The counter is then reset and, during the next one second period determined by the output 3A of the monostable the counter again counts the pulses transmitted from the oscillator 2. Thus, during each alternative second there is stored in the binary counter 5 a count which is dependent upon the frequency of oscillation of the oscillator 1, and in turn upon the temperature sensed by the th rmistor contained therein. Since the period of the monostable 3 is determined by the output from the oscillator 1, it is ensured that any variation in the frequency of the oscillator 2 caused by variation in the characteristics of components other than the thermistor is compensated.

The ripple counter 7 is arranged to provide an output after a predetermined number of periods of the monostable 3, for example at 128 second intervals, and this output, in conjunction with the output 3B from the monostable received at the AND gate 8 is effective to cause the binary count stored within the counter 5 to be read into the memory 6. It will be appreciated that the memory 6 is a type which provides a plurality of locations for the storage of data, and that upon receipt of consecutive read commands via the AND gate 8, the data presented thereto is stored in different addresses. The memory may, for example, comprise a shift register. Thus, the memory 6 serves to store in serial form data presented thereto at each 128 second interval by the binary counter 5.

Upon completion of the data recording and storage operation, the information may be retrieved from the memory 6, for example by applying the output of a decode clock oscillator 9 to a read input thereof, and recording the information either in a corresponding digital device 10, or upon a chart recorder 11 by way of a digital to analog converter 12 and an amplifier 13 which may incorporate an offset to enable linearisation and calibration of the stored data values.

It will be appreciated that a data recording and storage device as described above may be constructed in very compact and simple manner as a rechargeable electronic unit capable of being placed in a desired environment, for example within an article to be treated on a production line, and will record over a period of time data which may be retrieved subsequently when convenient. With suitable selection of its components the unit may be rendered resistant to medium temperatures without insulation, and higher temperatures with insulation. Moreover, although the device has been described by way of example with reference to the sensing of temperature, it will be appreciated that other parameters may be sensed by the replacement of the thermistor with a correspondingly sensitive element. Moreover, by selection of the period of the ripple counter 7 data may be stored at any desired intervals of two seconds upwards, the only limitation being the capacity of the memory 6 and the period of time over which monitoring of the relevant parameter is desired. Of course, it would be possible to dispense with the ripple counter 7 altogether, and to cause the reading of the output of the counter 5 into the memory 6 directly by the output of the monostable 3. It will be appreciated that suitable delay devices are provided so that reading of the output from the binary counter 5 and resetting of the counter prior to commencement of the next count take place in the appropriate order.

## CLAIMS

1. A device for recording and storing information in relation to the variation of a predetermined parameter over a period of time, comprising a first oscillator arranged to oscillate at a frequency providing a reference standard, a second oscillator of generally similar characteristics to the first but incorporating an element of which the characteristics vary with said predetermined parameter whereby the oscillator frequency correspondingly varies, a counter connected to the output of said second oscillator by way of a sampling gate, a memory connected to the output of said counter and providing a plurality of information storage locations or addresses, a monostable of which the period is controlled by said first oscillator, said monostable providing a first, set period during which the sampling gate is opened to permit actuation of the counter by the output of the second oscillator and a second, reset period during which the staticised output of the counter is made available to be read into the memory and then the counter is reset, and means, actuated either during each reset period of the monostable or during selected reset periods, for causing the output of the counter to be read into a corresponding location of the memory and for preparing a new location in the memory to receive the next count to be read therein.

2. A device as claimed in Claim 1, in which the said parameter in repsect of which information is

to be stored is temperature, and the two oscillators are constructed of components which, with the exception of the specific temperature sensor element providing for variation of the frequency of the second oscillator, are closely matched to one another so that any variation of characteristics with temperature is the same for both oscillators.

3. A device for recording and storing information, substantially as described herein with reference to the accompanying drawing.

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